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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LIU, MICHAEL

ART UNIT

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NOTIFICATION DATE

DELIVERY MODE

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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/587,268	Applicant(s) TAKAIWA ET AL.	
	Examiner Michael Liu	Art Unit 2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 December 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7-40 and 42-51 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-5, 7-23 and 48 is/are allowed.
- 6) ☒ Claim(s) 24-40, 42-47 and 49-51 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11/30/09</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Receipt is acknowledged of the Amendment filed on 22 December 2009. By the amendment, claims 1, 4, 7, 8, 12, 16, 20, 21, 24, 26, 30-33, 36, 42, 46, and 48-51 have been amended, and claims 6 and 41 have been canceled. Accordingly, claims 1-5, 7-40, and 42-51 are pending in the instant application.

Information Disclosure Statement

2. The Office Actions cited in the Information Disclosure Statement filed on 30 November 2009 have been considered by the examiner. However, the Office Actions have been lined through in the IDS, as Office Actions should not be cited on the cover page of a patent.

Specification

3. The amendments to the specification have been considered.

Claim Objections

4. The amendments to claims 1 and 30 have been considered, and as a result, the claim objections are withdrawn.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 24-35 and 49 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 24 recites "the immersion area having a size that is smaller than an area of the surface of the substrate onto which the image

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of the pattern is projected.” However, Fig 1 shows that the immersion area AR2 is larger than the projection area AR1, which is the area of the surface of the substrate onto which the image of the pattern is projected. Moreover, [0048] of the instant publication discloses the immersion area AR2 being larger than the projection area AR1. As a result, the claim language of claim 24 is contradictory to the disclosure. Therefore, claim 24 is rejected as being unclear and indefinite, and claims 25-35 and 49 are similarly rejected due to their dependency on claim 24.

Claim Rejections - 35 USC § 102

7. Despite the claim amendments, the rejections under Mulken and Kroupenkin are maintained. However, the rejections under Iriguchi and Streefkerk are withdrawn.

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 36, 37, and 50 are rejected under 35 U.S.C. 102(e) as being anticipated by Mulken et al (US 2005/0132914).

Claim 36: Mulken discloses an exposure apparatus (Fig 1) comprising:

a substrate stage (WT) on which a substrate (W) is held, the substrate stage being movable while holding the substrate ([0099]);

a projection optical system (PL) through which an image of a pattern (MA) is projected onto the substrate held by the substrate stage when the substrate is disposed adjacent to a final optical element (9) (Fig 5) of the projection optical system, a liquid being provided in a space between the final optical element and the substrate so as to contact the final optical element and the substrate; and

a shape detection apparatus (22) that obtains a shape of the liquid ([0105]: determines quantity, and hence height or topographical shape, of immersion liquid present) on an object (W) which is movable on an image plane side of the projection optical system, the object being at least one of the substrate stage, the substrate and a member that moves with the substrate stage.

Claim 37: the detection apparatus (22) has an emitting portion that emits a plurality of detection light ([0105]) arrayed in a vertical direction with respect to a surface of the object, and a light receiving portion, wherein the detection apparatus obtains the shape of the liquid based on a light receiving result of the light receiving portion.

Claim 50: A device manufacturing method comprising:
exposing the substrate (W) through the projection optical system (PL) of the exposure apparatus (Fig 1) according to Claim 36; and
processing the exposed substrate ([0072]).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 38-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulkens as applied to claim 36 above, and further in view of Kroupenkine et al (6,538,823).

Mulkens discloses all limitations except for obtaining a contact angle of the liquid.

However, Kroupenkine teaches in Fig 1A light waves 16 being incident upon a droplet 12 of liquid from above. From this configuration, the contact angle θ can be determined using Equations (2) and (3). By determining the contact angle, an affinity of the liquid for the object and a height of the liquid can both be obtained.

At the time the invention was made, it would have been obvious to use the detection apparatus of Mulkens to additionally obtain the contact angle of the liquid with respect to the object, as taught by Kroupenkine, for the purpose of determining the attraction between the liquid and the object, in order to achieve optimal immersion exposure by selecting the necessary optical elements to accurately focus the projection beam on the substrate surface ([0105]).

12. Claims 42-47 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulkens in view of Kroupenkine.

Claim 42: Mulkens discloses an exposure apparatus (Fig 1) comprising:

a substrate stage (WT) on which a substrate (W) is held, the substrate stage being movable while holding the substrate ([0099]);

a projection optical system (PL) through which an image of a pattern (MA) is projected onto the substrate held by the substrate stage when the substrate is disposed

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adjacent to a final optical element (9) (Fig 5) of the projection optical system, a liquid being provided in a space between the final optical element and the substrate so as to contact the final optical element and the substrate; and

a detection apparatus (22) that detects the liquid ([0105]), on an upper surface of the substrate stage that holds the substrate, with respect to the upper surface of the substrate stage.

Mulkens does not disclose expressly detecting a contact angle of the liquid.

However, Kroupenkine teaches in Fig 1A light waves 16 being incident upon a droplet 12 from above. From this configuration, the contact angle θ can be determined using Equations (2) and (3).

At the time the invention was made, it would have been obvious to use the detection apparatus of Mulkens to additionally obtain the contact angle of the liquid with respect to the upper surface of the substrate stage, as taught by Kroupenkine, for the purpose of determining the attraction between the liquid and the substrate, in order to achieve optimal immersion exposure by selecting the necessary optical elements to accurately focus the projection beam on the substrate surface ([0105]).

Claim 43: Mulkens as combined discloses the contact angle of the liquid with respect to the upper surface of the substrate stage is obtained periodically ([0105]: contact angle obtained during every detection before exposure by detector 22).

Claim 44: Mulkens as combined discloses the upper surface of the substrate stage (WT) includes a surface of a member (9-12) which is replaceably disposed on the substrate stage, and the member is replaced based on the detected contact angle.

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([0105]: "Based on the measurement by detector 22, the controller 21 determines which one or more of optical elements 9, 10, 11, 12 is/are necessary.")

Claim 45: Mulkens discloses the upper surface of the substrate stage (WT) includes a surface of the substrate (W) held by the substrate stage (Fig 5).

Claim 46: Mulkens discloses further comprising:

a liquid supply system having a supply port (IN) (Fig 2), that supplies the liquid;

a liquid recovery system having a recovery port (OUT), that recovers the liquid;

and

a controller (21) that controls an operation of at least one of the liquid supply system and the liquid recovery system based on the detected contact angle ([0106]: liquid supply system supplies liquid based on detector).

Claim 47: Mulkens as combined teaches all limitations except for the detection light being infrared light.

However, Mulkens teaches detecting liquid using low intensity EM waves ([0105]). Since it is known that infrared light propagates at low intensity relative on the light spectrum, infrared light can be reasonably interpreted to be low intensity EM waves.

At the time the invention was made, it would have been obvious to one of ordinary skill in the art to recognize that infrared light is equivalent to low intensity EM waves and can be used as the detection light of Mulkens, for the purpose of accurately detecting the presence of immersion liquid to achieve quality exposure.

Claim 51: A device manufacturing method comprising:

exposing the substrate (W) through the projection optical system (PL) of the exposure apparatus (Fig 1) according to Claim 42; and
processing the exposed substrate ([0072]).

Allowable Subject Matter

13. Claims 1-5, 7-23, and 48 are allowed.
14. The following is a statement of reasons for the indication of allowable subject matter: There is no prior art that discloses, in combination with the claimed limitations, a detection apparatus that detects whether the liquid is present on an object that is disposed lower than the final optical element of the projection optical system at a time when the image of the pattern is projected by the projection optical system onto the substrate, the object being at least one of the substrate stage, the substrate and a member that moves with the substrate stage..

Response to Arguments

15. Applicants' arguments with respect to the rejection of claim 1 under Mulken have been fully considered and are persuasive. The Mulken rejection of claim 1 has been withdrawn.
16. Applicants' arguments with respect to the rejection of claims 1, 24, and 36 under Iriguchi have been fully considered and are persuasive. The Iriguchi rejection of claims 1, 24, and 36 has been withdrawn.
17. Applicants' filing of the English translation of the foreign priority with respect to the rejection under Streefkerk has been fully considered and is persuasive. The Streefkerk rejection of claims 1, 24, and 36 has been withdrawn.

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18. Applicants' arguments with respect to the rejection(s) of claim 42 under Kroupenkin have been fully considered and are persuasive. Therefore, the Kroupenkin rejection of claim 42 has been withdrawn.

19. Applicants' arguments with respect to the rejection of claim 42 under Mulken and Kroupenkin have been fully considered but they are not persuasive. Applicants argue, "Applicants respectfully submit that there would have been no reason for one having ordinary skill in the art to modify the Mulken et al. exposure apparatus in view of Kroupenkin et al. to result in the combination of features recited in independent claim 42" (P18L5-7). The examiner respectfully disagrees. The detector 22 of Mulken is utilized to determine the quantity of immersion liquid present, and based on the measurement, the controller 21 can determine which one or more of optical elements 9, 10, 11, and 12 is/are necessary to ensure that the projection beam PB is accurately focused on the upper substrate surface ([0105]). Kroupenkin teaches determining the contact angle θ of the liquid 12 with respect to the substrate 14 (Fig 1A; C2L43-44). By utilizing the contact angle determination means of Kroupenkin in the invention of Mulken, the contact angle of the liquid can be determined. By determining the contact angle, which defines the attraction between the liquid and the substrate, the controller 21 of Mulken can better determine which optical elements 9-12 to select in order to accurately focus the projection beam on the substrate surface ([0105]).

Moreover, in response to Applicants' argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon

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hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). The motivation for combining Mulkens with Kroupenkine is to determine the attraction between the liquid and the substrate in order to better determine which optical elements 9-12 to select in order to accurately focus the projection beam on the substrate surface, which is taught in [0105] of Mulkens. As a result, Mulkens and Kroupenkine can be combined to teach to features of claim 42. Thus, Applicant's arguments on this point are not persuasive.

Conclusion

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Liu whose telephone number is 571-272-9019. The examiner can normally be reached on Monday through Friday 9 am - 5 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on 571-272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Michael Liu/
02/24/10

Michael Liu
Examiner
Art Unit 2882

/Peter B. Kim/
Primary Examiner, Art Unit 2882